largely due to the fact that the close balance between draft and resistance is disturbed by barometric and temperature conditions. These various losses will be discussed in more detail in the design computations for a furnace.

Figs. 162 and 163 give a graphical comparison of chimney areas and heights which are tabulated in Table 10. Open-hearth practice in the United States tends to the use of self-supporting steel chimneys lined with firebrick. Even with waste-heat boilers and induced draft, the straight chimney is used, while abroad many of the venturi cone (Prat type) chimneys are used. The chimney is a necessity, as the waste gases must be carried to a sufficient height to prevent their becoming a nuisance, not only in the works, but to its neighbors.

Another factor which must be considered, in connection with the draft required to operate the furnace, is that the gases must be pulled out of the furnace through the ports, down through the checkers and through the valves and flues; that is, the waste-gas end of the furnace is below atmospheric pressure, and there is a constant tendency for cold air to be pulled into the system. When this brickwork is new and tight the leakage of air into the system may be slight, but after a few explosions have shaken things up, the brickwork is liable to leak like a sieve. For this reason, gas samples taken at the base of the stack are liable to show a condition of affairs quite different from that which actually exists in the gases leaving the heating chamber or the regenerators.

A great many tests and considerable investigation of open-hearth furnaces have been made, from time to time, at different plants. Tests of this kind cannot be permitted to interfere with furnace operation. They must be carried on night and day, over several melts. When it is decided to run such a test the question of cost must be considered, not only in apparatus,

but in personnel. A large number of observations and chemical analyses must be made and the results analyzed.

Very slight details are liable to vitiate the value of such tests and it is extremely difficult to impress upon the available assistants the factors that are really essential; frequently, in fact, the busy executive is unable to devote the preliminary attention he desires to the test scheme, and, as a result, only a portion of the data desired is obtained. Comparatively few of these tests are made known, hence there is much repetition of the work of others.